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Subsurface Drainage Installation — A Farmer Survey

Introduction

Waterlogged and saline soils are a major problem in much of Alberta. Up to 11 million acres (4.5 million hectares) of the arable land within the province is affected. Subsurface (tile) drainage is a viable means of reclaiming many of these lands. There are presently about 700 on-farm drainage sites located across the province (Figure 1).

An initial survey of irrigation farmers (*What Farmers Think of Tile Drainage*, Agdex 555-1) obtained detailed information about drainage under irrigation. A second survey of 242 irrigation and dryland farmers has recently been completed to evaluate overall farmer perception of drainage installation features across the province.

Survey results discussed

General

Distribution: Most drainage sites (60%) are located in dryland areas and about two-thirds of dryland drainage is south of Drumheller, Alberta. The remaining drainage sites (40%) are located within irrigation districts. Previously, drainage installation within Alberta has been closely divided between irrigated and dryland parcels but this ratio may be shifting.

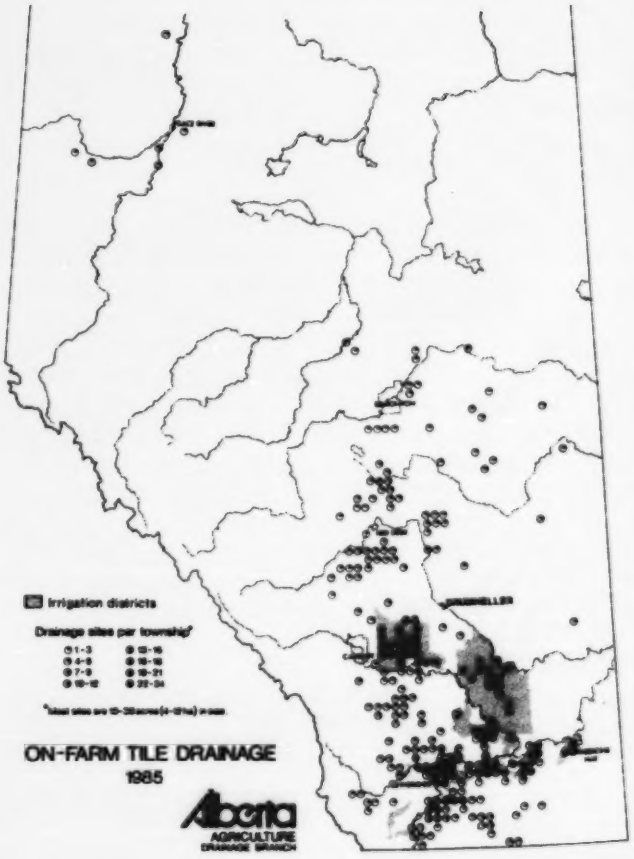

Figure 1. On-farm subsurface drainage sites within Alberta.

Figure 2. Major drainage problem causes include canal seepage, natural groundwater flows and surface ponding.

Problem Causes: Irrigation farmers believe most of their drainage problems (57%) are associated with canal seepage (Figure 2). However, these farmers also believe seepage is only one of several factors simultaneously contributing to the problem. Another major problem cause in one of four cases is thought to be groundwater flow and high water tables from natural sources. Irrigation management is considered important only five per cent of the time. Irrigation farmers commonly express the view that on-farm irrigation itself causes few drainage problems.

Copies of this and related publications may be obtained from the Print Media Branch, Alberta Agriculture, 7000 - 113 Street, Edmonton T6H 5T6 or Alberta Agriculture's District Offices.

High water tables from natural sources are thought responsible for a large part (46%) of dryland problems. Combinations related to poor surface drainage (ponding related) are also considered to be a major cause (41%). North of Drumheller poor surface drainage is considered to be the cause of salinity problems twice as often as in the south.

Investigation

Agency: Within irrigation districts about half of all subsurface drainage investigations involve a government agency — principally Alberta Agriculture. In dryland areas government investigators are only involved about 30 per cent of the time. Most of the province's early drainage investigation resources were headquartered at Lethbridge. These resources are gradually becoming dispersed across the province.

Contractors design slightly more than one-third of all sites originally investigated by the government. The government, however, is rarely involved in contractor investigation/designs. Once government agencies have provided an initial site investigation, a farmer may want to proceed with drainage faster than government design resources can respond. Contractor investigation/designs generally involve a relatively short time frame.

Method: Roughly half of all site investigations involve simply walking over the affected area. Such limited investigations might restrict drainage performance where a knowledge of soil characteristics could be critical to optimum drainage design. Only 30 per cent of investigations involve detailed soil and groundwater investigation with drill equipment (Figure 3). Government agencies routinely involve drilling and soil sampling in their investigations and likely account for the bulk of detailed investigations.

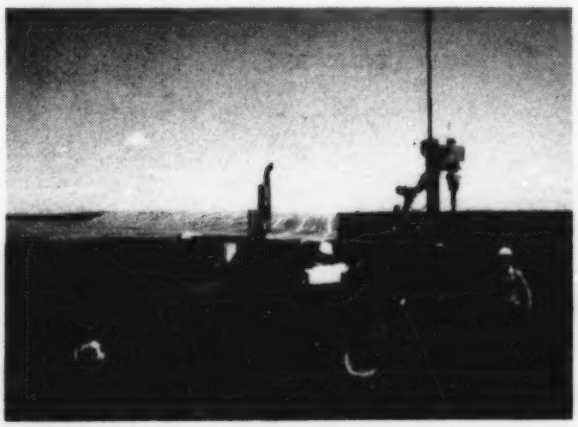

Figure 3. Detailed soil and groundwater investigations could be critical to optimum drainage design.

Plans: Drainage systems are constructed from a final drafted plan about 45 per cent of the time. The content of final plans varies considerably. Elevations, cuts and grades on individual laterals are generally included in government plans. Contractor-drafted plans are usually less detailed, often emphasizing routing and mainline specifications only. About one-third of the systems are constructed according to in-field calculations only.

System Characteristics

Type: Within irrigation districts almost half of the drainage consists of a systematic grid (Figure 4). The high cost of land, higher incidence of salinity, and source of drainage problems associated with irrigated land, are likely reflected in this intensity of grid drainage. Other types of drainage occupy lesser portions.

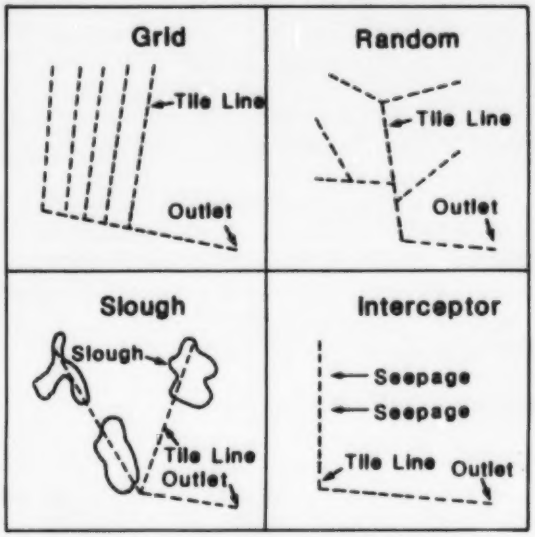

Figure 4. Common types of subsurface drainage systems.

On dryland north of Drumheller, slough drainage is the main type of system installed. In the south, most dryland drainage is divided between slough and grid systems, with random systems used about 20 per cent of the time. The variety of dryland drainage systems reflects the greater diversity of dryland drainage problems and lower general land values.

Size: Drainage sites (irrigated and dryland) include many small parcels and only a few large areas. Two-thirds of sites are smaller than the average parcel size of 30 acres (12 hectares). Half are less than 20 acres (8 hectares). Drainage sites are generally a small part of a much larger field management unit. Only 10 per cent cover 60 acres (24 hectares) or more. Most (70%) contain less than the average length of 7600 feet (2500 metres) of drainage tubing. Half contain less than 4,000 to 5,000 feet (1,200-1,500 metres) of tubing.

Outlet: More than 90 per cent of all drainage systems have free-flow gravity outlets. Less than 10 per cent involve a sump or lift pump. A gravity outlet is preferable, but only if the receiving channel is deep enough to keep the outlet free from obstruction. Almost half of all subsur-

face drainage systems discharge into a natural drain. The rest are divided among canals, dugouts and road borrow pits. Outlet channels are critical to the long term operation of drainage systems. Drainage into road borrow pits generally provides only marginal outlet due to their shallow nature and lack of adequate grade. Unauthorized outlet into road ditches is not recommended.

Installation

Season: More subsurface drainage is installed during the fall than during any other season — about 45 per cent of total drainage (Figure 5). Most sites are driest in the fall, making installation easier. Irrigated drainage activity is also high in the spring. Though spring soils can be wet, spring installation generally involves lower crop losses. Wet soils and high value cash crops cause summer installation demand to be low on irrigated land. Winter installation is minimal.

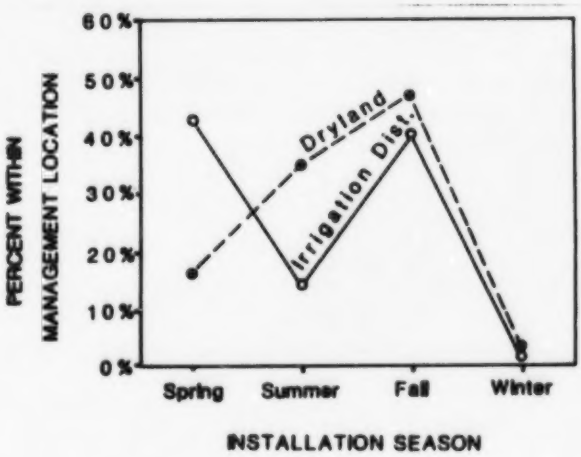

Figure 5. Most drainage is installed in the fall although spring and summer are also busy times.

Trends: The number of subsurface drainage sites within Alberta (670 in 1985) is gradually increasing, but the annual rate has declined from about 100 sites in 1982 to 25 sites in 1985. The stable relationship between irrigated and dryland installation rates of 1977-1983 (Figure 6) has shifted in recent years. Drainage installation south of Drumheller has declined. The last two to three very dry cropping seasons within southern Alberta may have reduced interest in drainage reclamation as concerns have shifted to meeting water deficiencies. Lower crop values have also reduced farmers' investment flexibility. Some sloughs have dried, however, making them easier and cheaper to drain.

Project Completion: Most drainage sites are completed by the contractor to the general satisfaction of the landowner in terms of quality of installation and system adequacy (Figure 7). On irrigated lands this amounts to 84 per cent initial satisfaction. Where potential returns are high and reclamation inputs can be optimized, intensive drainage is generally installed the first time on irrigated land. Dryland drainage seems to require some follow-up (70% satisfactory; 10% initially satisfactory/later improved) to achieve the same level. On dryland there may be a greater tendency to install trial systems that later require upgrading.

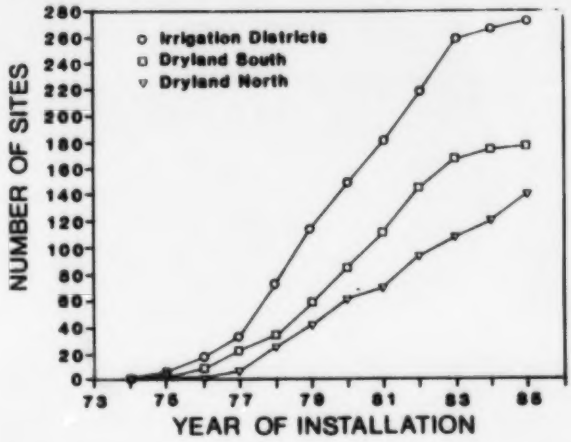

Figure 6. The annual rate of drainage installation south of Drumheller has declined recently.

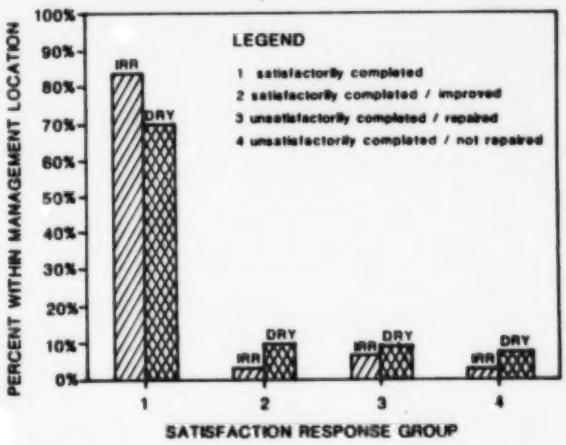

Figure 7. The vast majority of farmers are satisfied with the quality of drainage installation in Alberta.

Less than 15 per cent of all sites require repair. Only about 7 per cent of sites are deemed unsatisfactory in the end. Independent of whether initial project installation is satisfactory, over 90 per cent of landowners consider the final status of their system as satisfactorily installed. This high level indicates that farmers are pleased with current drainage installation technology and do not perceive installation practices to be a limitation to future drainage expansion within the province.

Farmers will continue installing subsurface drainage. With an improved economic climate the rate of subsurface drainage installation across Alberta should again escalate.

Summary

A survey of 242 farmers from across Alberta having subsurface drainage on their land indicates:

1. **Distribution** — most drainage sites (60%) are located in dryland areas with the remainder (40%) within irrigation districts.
2. **Problem Causes** — most irrigation farmers (57%) believe their drainage problems are associated with canal seepage and seepage related combinations. High water table contributions from natural sources (46%) and poor surface drainage (41%) are thought responsible for most dryland problems.
3. **Investigation Agency** — about half of irrigation drainage investigation is performed by Alberta Agriculture, the remainder by contractors. Contractors do most dryland work. Contractors design more than a third of the sites initially investigated by the government. The government is rarely involved in contractor-initiated investigation/designs.
4. **Method/Plan** — 50 per cent of all site investigations simply involve walking over the area to be drained. Only 30 per cent involve a drilling program for soils and groundwater information. Almost 50 per cent of drainage systems are constructed according to a final drafted plan. Many (35%) are constructed according to field calculations only.
5. **System Type/Size** - 50 per cent of irrigation drainage is systematic grid. Dryland drainage is predominantly slough type north of Drumheller and is largely divided between slough and grid systems in the south. Most drainage sites (67%) are less than 30 acres (12 hectares) in size. Most (70%) incorporate less than 7,600 feet (2500 metres) of drain tubing.
6. **Outlet/Receiving Channels** — over 90 per cent of all outlets are gravity free-flow. Almost 50 per cent discharge into a natural drain. Canals, dugouts and road borrow pits are also used.
7. **Season/Trends** — fall is the busiest season for drainage installation (45%). During spring, most drainage activity is on irrigated land. Dryland drainage predominates during the summer. The annual rate of drainage installation has declined lately, perhaps due to the recent drought cycle and poor economic climate.
8. **Project Completion** — over 90 per cent of drainage sites are completed to the farmer's satisfaction. Less than 10 per cent are deemed to have unresolved installation problems.

Acknowledgements

Sincere thanks are expressed to the many farmers who were so considerate in answering the detailed questions of the survey. Their willingness to respond has provided a valuable data base for current analysis and future direction.

For further information

Those having further questions about this survey or other subsurface drainage matters are encouraged to contact their district agriculturist, irrigation specialist or the Drainage Branch, Agriculture Centre, Lethbridge (381-5159).

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